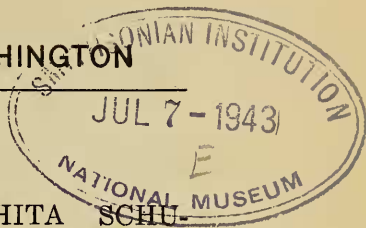


PROCEEDINGS
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THE MOLLUSCAN GENUS *TROCHITA* SCHUMACHER WITH A NOTE ON *BICATILLUS* SWAINSON.¹

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The genus *Trochita* was instituted by Schumacher in 1817 (*Essai Nouv. Syst. Habit. Vers Test.*, pp. 57, 184), and consisted of two sections, one typified by *Patella chinesis* Linne and the other by *Trochita spiralis* Schumacher, which he based on plate 4, figure A2 of the Favannes' *La Conchyliologie*, 1780. The earliest type designation of this genus that I have found is that of Gray (*Proc. Zool. Soc. London*, pt. 15, 1847, p. 158), who cites *Patella trochoides* as type. This designation is strictly speaking not valid, as the species *trochoides* appears nowhere in Schumacher's diagnosis. *Patella trochoides* Dillwyn 1817, is, however, synonymous with Schumacher's *Trochita spiralis*. Dall's designations of *Trochus radians* Lamarck as type (*U. S. Geol. Survey Prof. Paper* 59, 1909, p. 81) is similarly not valid in the strict sense, as *radians* is not mentioned by Schumacher, although it too is the same shell as *spiralis*. To put the genus on a firm basis, I am here designating as type of *Trochita* Schumacher 1817 the species *Trochita spiralis* Schumacher 1817 (= *radians* Lamarck 1816).

Trochita Schumacher 1817.

1817. *Trochita* Schumacher, *Essai Nouv. Syst. Habit. Test.*, pp. 57, 184. Type (here designated): *Trochita spiralis* Schumacher (= *T. radians* Lamarck).
 1830. *Trochatella* Lesson, *Voyage Coquille, Zoologie*, vol. 2, pt. 1, p. 396. Type (by monotypy): *Calyptrea araucana* Lesson (= *T. radians* Lamarck).
 1840. *Trochilla* Swainson, *Treatise on Malacology*, p. 355. Type (here designated): *Infundibulum pileus* Sowerby, 1839, not Lamarck, 1822 (= *Trochita radians* Lamarck).
 1867. *Clypeola* Gray, *Proc. Zool. Soc. London*, 1867, p. 735. Type (by tautonymy): *Trochita clypeolum* Reeve (= *T. decipiens* Philippi).

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Trochita is one of four rather closely related genera of the subfamily Calyptraeinae. One of these is *Calyptraea* Lamarck 1799, which inhabits in general the rather homogeneous zoogeographical area that I am calling the NEOTETHYAN AREA, which includes the tropical and subtropical east and west Atlantic regions, and the east Pacific region from Lower California to Ecuador. (I have chosen this name as the faunal similarity of this area is traceable to the post-Oligocene stage of Suess' Tethys Sea, when the Indo-Malaysian portion of that body of water became differentiated from the Atlantic-Mediterranean portion). The presence of a species of this genus (*C. capensis* Tomlin) in South Africa is worth noting. Two other genera are *Sigapatella* Lesson 1830 and *Zegalerus* Finlay 1926, which inhabit the Neozelanic and South Australian regions. *Trochita* itself is found in the Peruvian, Magellanic and South African provinces and is thus zoogeographically close to the Neozelanic groups; this distribution is interesting in that it points to the faunal kinship of these notal regions. There is also a species apparently inhabiting the West African region; this form is discussed more fully below.

The radula (figures 1, 2) differs from that of *Sigapatella* (Peile, Proc. Malac. Soc. London, vol. 16, pt. 1, 1924, p. 22, figs. 1, 2) in that the lateral teeth have a comparatively smaller cutting portion, the inner margin of which is without denticles, and the marginals are shorter, broader, more hook-like.

The male genitalia are strikingly like that of *Littorina irrorata* Say (see figure 3).² A detailed anatomical study of *Trochita radians* is given by Kleinstüber in Fauna Chilensis, vol. 4 (Zool. Jahrb., Suppl. 13), 1913, pp. 385-476.

Trochita radians Lamarck.

1742. ——— d'Argenville, Hist. Nat. Lith. et Conch., p. 240, pl. 6, fig. L.
 1768. ——— Knorr, Delic. Yeux et Esprit, pt. 3, p. 53, pl. 29, figs. 1, 2.
 1769. *Lepas intus concamerata*, ———, Martini, Conch. Cabinet, vol. 1, p. 162, pl. 13, fig. 135.
 1780. Le Bouton de Chapeau, Favanne, La Conchyliologie, vol. 1, p. 552, pl. 4, fig. A2.
 1791. *Patella trochiformis* var. Gmelin, Systema Naturae, ed. 13, vol. 1, pt. 6, p. 3694.
 1816. *Trochus radians* Lamarck, Encycl. Meth. (Vers) pl. 445, figs. 3a, 3b; Liste des objets, p. 10.
 1817. *Patella trochoides* Dillwyn, Descr. Cat. Recent Shells, vol. 2, p. 1018.
 1817. *Trochita spiralis* Schumacher, Essai Nouv. Syst. Habit. Test., p. 184.
 1822. *Trochus radians* Lamarck, Hist. Nat. An. s. Vert., vol. 7, p. 11.
 1829. *Trochus radians* Schubert & Wagner, Syst. Conch. Cab., vol. 12, p. 131, pl. 229, fig. 4063a, b.
 1830. *Calyptraea peruviana* Deshayes, Encycl. Meth., vol. 2, pt. 1, p. 170.
 1830. *Calyptraea* (*Trochatella*) *araucana* Lesson, Voyage Coquille, Zool., vol. 2, pt. 1, p. 396.
 1836. *Calyptraea radians* Deshayes, Hist. Nat. An. s. Vert., ed. 2, vol. 7, p. 626.
 1839. *Infundibulum pileus* Sowerby, Conch. Manual, p. 123, figs. 237-238; not of Lamarck.
 1841. *Calyptraea* (*Trochatella*) *trochiformis*, d'Orbigny, Voyage Amer. Merid., vol. 5, pt. 3, p. 461, pl. 59, fig. 3; not of Gmelin 1791.
 1846. *Infundibulum radians*, d'Orbigny, op. cit., p. 701.
 1852. *Trochita spirata* Forbes, Proc. Zool. Soc. London, pt. 18, 1850, p. 271.
 1854. *Trochita radians*, H. & A. Adams, Genera Moll., vol. 1, p. 366, pl. 40, fig. 5a.

² The radulae have been prepared by Dr. J. P. E. Morrison, who has also made the drawings used in this paper.

- ?1857. *Trochita ventricosa* Carpenter, Cat. Reigen Coll. Mazatlan Moll., pp. 264-265 (erroneous locality?)
 1891. *Trochatella radians*, Stearns, Proc. U. S. Nat. Mus., vol. 14, p. 328.
 1907. *Trochita trochiformis* Dall. Proc. U. S. Nat. Mus. (no. 1704), vol. 37, pp. 175, 233; not of Gmelin 1791.

Several species listed by Tryon (Manual of Conchology, vol. 8, 1886, pp. 121-122) as belonging to this species are not *Trochitas*, but probably *Crucibulum*. These are: *Calyptraea sordida* Broderip 1834, and *intermedia* d'Orbigny 1841.

I am not here considering the Tertiary forms as they will need careful study. Forms such as *Trochita costellata* Conrad (not Philippi 1845), *Calyptraea diabloensis* Clark, and *C. martini* Clark may be close to *Trochita radians* Lamarck, but for the present they had best be kept distinct.

This is the species which has been called *Trochita trochiformis* Gmelin (Dall l. c. and later authors), an error resulting at least in part from Tryon's lumping of the Magellanic and Peruvian forms.

Gmelin had quite correctly separated the Peruvian species as variety β of his *trochiformis*, but his typical form still contained a mixture which apparently no one has resolved. The confusion dates from Chemnitz, who in 1788 (Conchylien-Cabinet, vol. 10, p. 335, pl. 168, figs. 1626-1627) described and figured a species as *Patella trochiformis* from Tranquebar. As synonym he cited the quite different Falkland Island species described by the Favannes (see under *Trochita pileus* Lamarck below). Gmelin followed him (Syst. Nat., ed. 13, vol. 1, pt. 6, p. 3693), basing his description on Chemnitz, and adding four bibliographic references, which refer to *Trochita*. Later authors either synonymized Gmelin's name under *Trochita radians* Lamarck, or considered it the earliest name for this Peruvian form, regarding the Chemnitzian figure as bad, and the locality erroneous. A glance at Chemnitz's description and figure, however, shows that we are dealing with a species of *Bicattillus* (subgenus *Desmaulus* Rehder; see below). His phrase (literally translated) "Internally a thin lamella which is hollow inside arises from the center and sidewall," can only refer to a species of this group, and the locality is undoubtedly correct, as there are similar ribbed species from Ceylon and the west coast of India in the collection of the U. S. National Museum. Lack of sufficient material from southern India prevents fixing the exact relationship of *Bicattillus* (*Desmaulus*) *trochiformis* Gmelin. *Crucibulum verrucosum* Reeve 1859 and *Crucibulum violascens* Carpenter 1856 from Ceylon, are related species belonging to the subgenus *Desmaulus*.

Of the later authors Strebel (Zool. Jahrbüchern, Abt. Syst., Geogr., Biol. Tiere, vol. 24, pt. 2, 1906, pp. 159-162) has noted the difference between the Peruvian and Magellanic species.

According to specimens in the U. S. National Museum, *Trochita radians* ranges from Manta, Ecuador, to Valparaiso, Chile.

The radula of a specimen from Pisco, Peru, collected by R. E. Coker (U. S. N. M. No. 207730) is shown in figure 1.

Trochita pileus Lamarck.

1780. *Le Lepas volute*, Favanne, La Conchyliologie, vol. 1, p. 551, pl. 4, fig. A1.
 1817. *Patella trochiformis* Dillwyn, Deser. Cat. Recent Shells, vol. 2, p. 1018 (in part).
 1822. *Trochus pileus* Lamarck, Hist. Nat. An. s. Vert., vol. 7, p. 11.
 1841. *Trochus pileus* Delessert, Recueil Coquilles Lamarck, pl. 34, figs. 5a, b.
 1845. *Calyptraea costellata* Philippi, Archiv f. Naturgeschichte, vol. 12, pt. 1, p. 62.
 1859. *Trochita corrugata* Reeve, Conch. Iconica, vol. 11, *Trochita*, pl. 2, sp. 9.
 1867. *Clypeola corrugata* Gray, Proc. Zool. Soc. London, 1867, p. 735.
 1898. *Calyptraea (Trochita) radians* Melvill and Standen, Journ. of Conch., vol. 9, p. 101; not Lamarck 1816.

This species is found on the mainland from the region of Tierra del Fuego and the Straits of Magellan north to Cabo San Antonio, northern Argentina (Strebel, Wiss. Ergebn. Schwed. Südpolar-Exped. 1901-03, vol. 6, pt. 1, Die Gastropoden, p. 59). It also inhabits the Falkland Islands.

I have shown above that the name *trochiformis* Gmelin cannot be used for this species as Dillwyn and later authors have done. The next available name is that of Lamarck.

Trochita decipiens Philippi.

1845. *Calyptraea decipiens* Philippi, Archiv f. Naturgeschichte, vol. 12, pt. 1, pp. 61-62.
 1859. *Trochita clypeolum* Reeve, Conch. Icon., vol. 11, *Trochita*, pl. 3, sp. 14.
 1867. *Clypeola magellanica* Gray, Proc. Zool. Soc. London, 1867, p. 735.
 1867. *Clypeola corrugata* var. *laevis* Gray, l. c., p. 735.

The validity of this form, which inhabits the same region as the foregoing species, is doubtful as it may be only a smooth variant of it—Strebel so considers it.

The radula of this form is shown in figure 2, taken from a specimen collected in the Magellan Straits by the U. S. Bureau of Fisheries in 20 fathoms (Sta. 2777). It differs from that of *Trochita radians* in lacking denticles on the edges of the marginals; otherwise, they are very similar.

Trochita helicoidea Sowerby.

1883. *Trochita helicoidea* Sowerby, Thesaurus, vol. 5, pp. 64-65, pl. 449, figs. 53-54.
 1892. *Trochita helicoidea*, Sowerby, Marine Shells of South Africa, p. 39.
 1915. *Trochita helicoidea*, Bartsch, U. S. Nat. Mus. Bull. 91, p. 136.
 1932. *Trochita helicoidea*, Turton, The Marine Shells of Port Alfred, S. Africa, p. 154.

This species resembles the Magellanic form in being umbilicated, but has noticeably convex whorls.

This name, originally based on a specimen from an unknown habitat, was assigned by Sowerby himself only nine years after the original description, to this South African form. Hence this identification is here accepted, as has generally been done, although the original figure shows a shell differing from the normal ones in having an involute columellar margin as is found in certain *Crepidulas*.

Specimens in our collection come from Jeffreys Bay on the Humansdorp coast, west of Port Elizabeth, and from Port Alfred.

Trochita species.

1853. *Calyptraea radians* Dunker, Index Moll. ad Guineam Inf. coll. Tams, p. 36.
 1893. *Trochatella radians*, Stearns, Proc. U. S. Nat. Mus., vol. 16 (no. 940), p. 335.

1898. *Calyptraea radians*, Locard, Exped. Sci. Travailleux et Talisman. Moll. Test., vol. 2, p. 62.
 1909. *Calyptraea radians*, Nobre, Bull. Soc. Portugaise Sci. Nat., vol. 3, suppl. 2, p. 3.
 1911. *Calyptra (Trochita) radians*, Dautzenberg, Ann. Inst. Oceanogr. Monaco, vol. 5, fasc. 3, p. 50.

This species has been found at Benguela and Mossamedes Bay (subfossil as well as living at the latter locality) in Angola, and in the Cape Verde Islands, with no record from the intervening area. There has been no description or figure published of this form, which has been said to be inseparable from the Peruvian-Chilean species. The only specimen I have seen is that mentioned by R. E. C. Stearns from Porto Grande, Cape Verde Islands, a broken, wave-worn shell, which, if there were no further records of this species from these islands I would have unquestionably called a ballast shell, as in that condition it is hardly distinguishable from *Trochita radians*. Under these circumstances I deem it unwise to name this form until better specimens come to hand. For the same reasons an extended discussion of the presence of this southern group in such northerly waters would be meaningless.

Trochita phlyctiphora Rochebrune, 1883, from Senegambia, is not a true *Trochita*, judging from the brief description.

The name *Bicatillus* Swainson 1840 (Treatise Malac., p. 5) has usually been bestowed on the recent species grouped around *extinctorium* Lamarck. Swainson included under his genus two species. One was *Bicatillus extinctorium* Swainson, which he based on what Sowerby (Genera of Shells, *Calyptraea* 1824, fig. 3) had called *Calyptraea extinctorium*?. This is not Lamarck's species but is apparently *Crucibulum imbricatum* Sowerby. The other species listed by Swainson was *B. deformis* DeFrance from the Miocene of Bordeaux, France. This species was chosen as the genotype in 1846 by Herrmannsen (Index Gen. Malac., vol. 1, p. 112), the earliest type designation I have been able to find, and so this name will have to be restricted to the Miocene species *Bicatillus deformis* DeFrance and its varieties (see Cossmann and Peyrot, Conchologie Neogenique Aquitaine, vol. 3, Livr. 3, 1919, pp. 496-497, 500).

For the recent species from the Indian Ocean and Malaysian region I am proposing the subgenus:

Desmaulus, new subgenus.

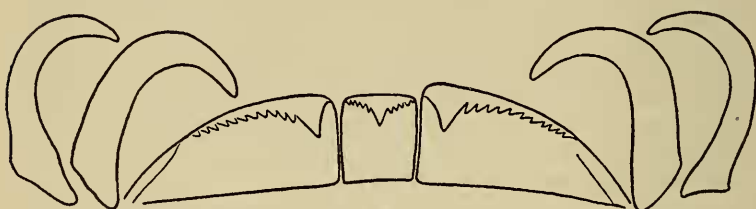
Genotype: *Calyptraea extinctorium* (Lamarck) Blainville (Manual de Malac., 1825, pl. 48 bis, fig. 8).

This group differs from typical *Bicatillus* in that the free margin of the internal lamella is folded over, forming a straight, hollow, somewhat flattened, cornucopia-like tube. In the Miocene group the free edge of the somewhat shorter lamella is merely slightly thickened. The muscle scar in *Bicatillus* is elongate, while in *Desmaulus* it is irregularly circular.

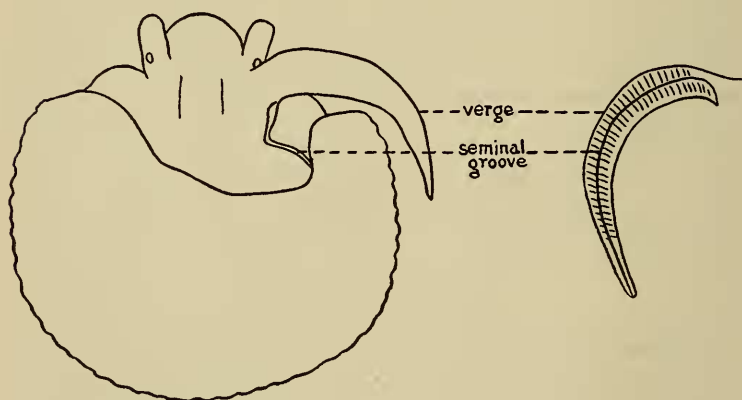
I am basing the genotype on Blainville's figure of *extinctorium*, as Lamarck's original description is unsatisfactory and Delessert's figure of this species (Receuil Coq. Lamarck, 1821, pl. 25, fig. 2.) is not very good.



1



2



RADULAE AND GENITALIA OF THE GENUS TROCHITA.